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Jansen

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(54) **PISTON COMPRESSOR**

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F04B 53/16 (2006.01)

(52) **U.S. Cl.** **417/437**; 92/169.1

(58) **Field of Classification Search** 417/437, 417/535–537

See application file for complete search history.

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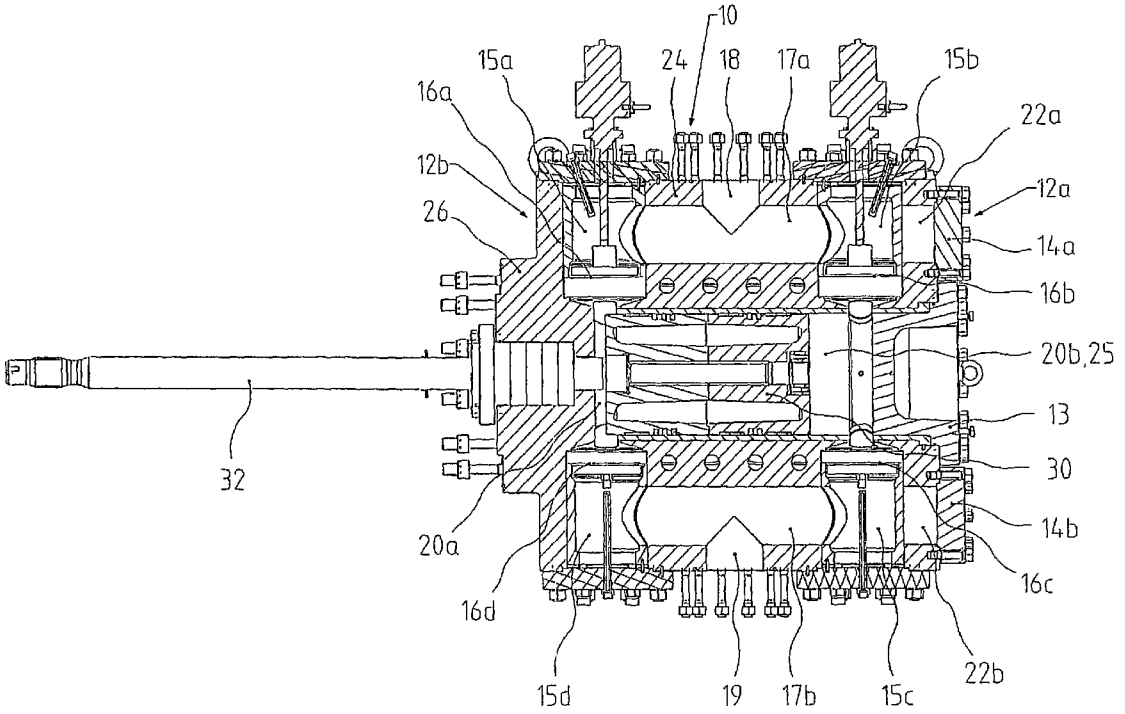
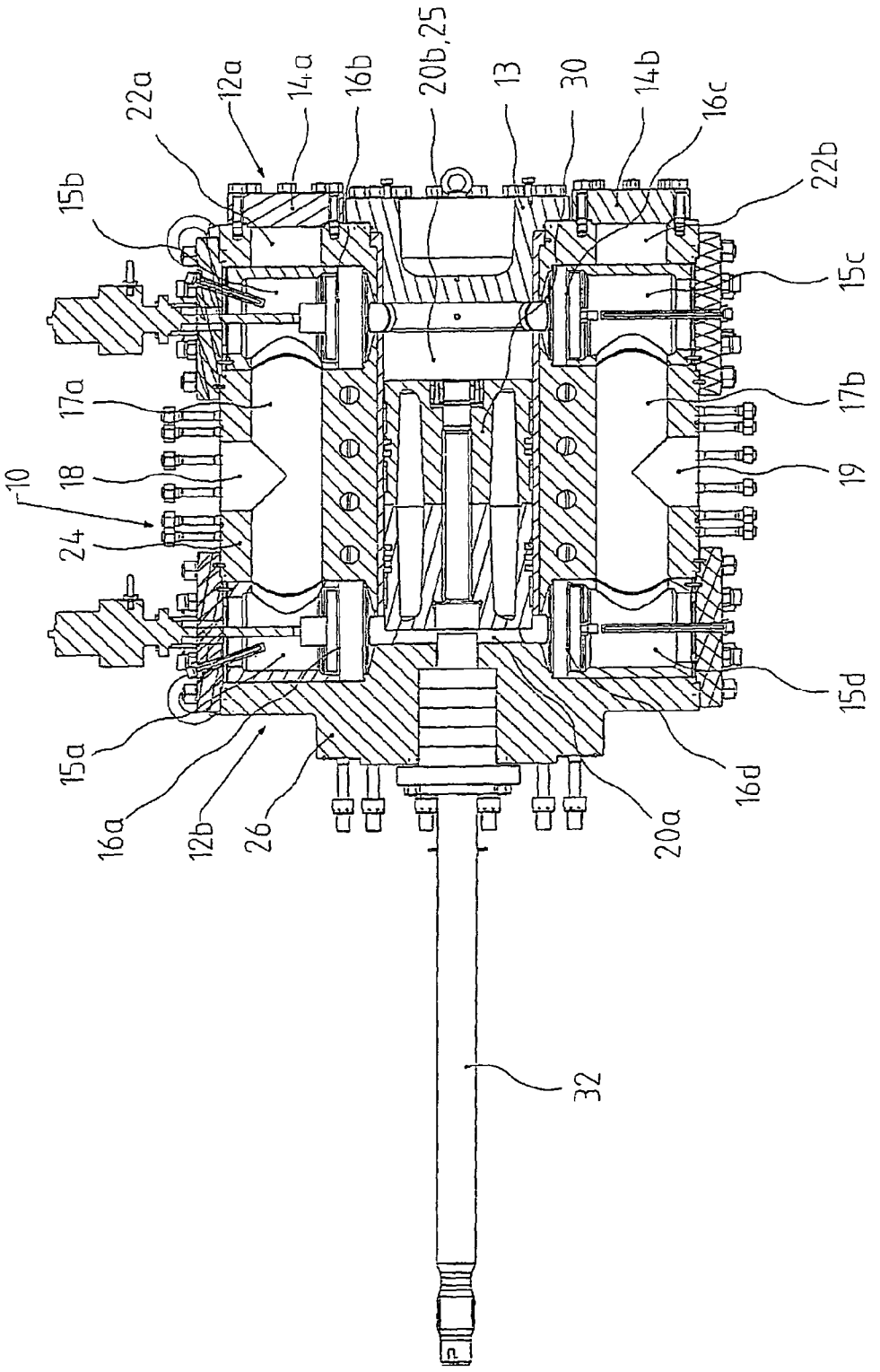
(57) **ABSTRACT**

A piston compressor with at least one compression cylinder having a piston, and with one suction port and one pressure port is described. The suction port and the pressure port are arranged at one end face of the compression cylinder.

10 Claims, 4 Drawing Sheets

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12a
14a
16b
20b,25
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30
14b
16c
22b
15b
15c
17a
17b
10
18
19
24
15d
15a
16d
16a
12b
26
20a
32

Fig.1

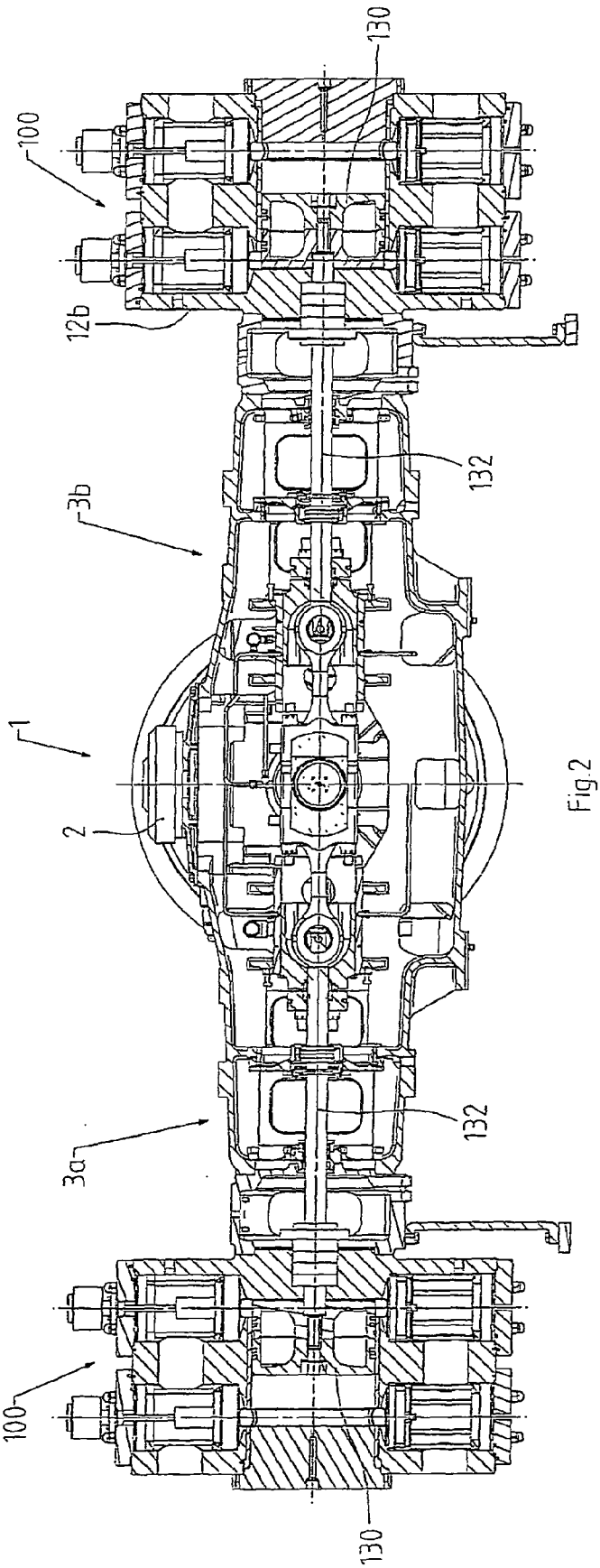

Fig.2

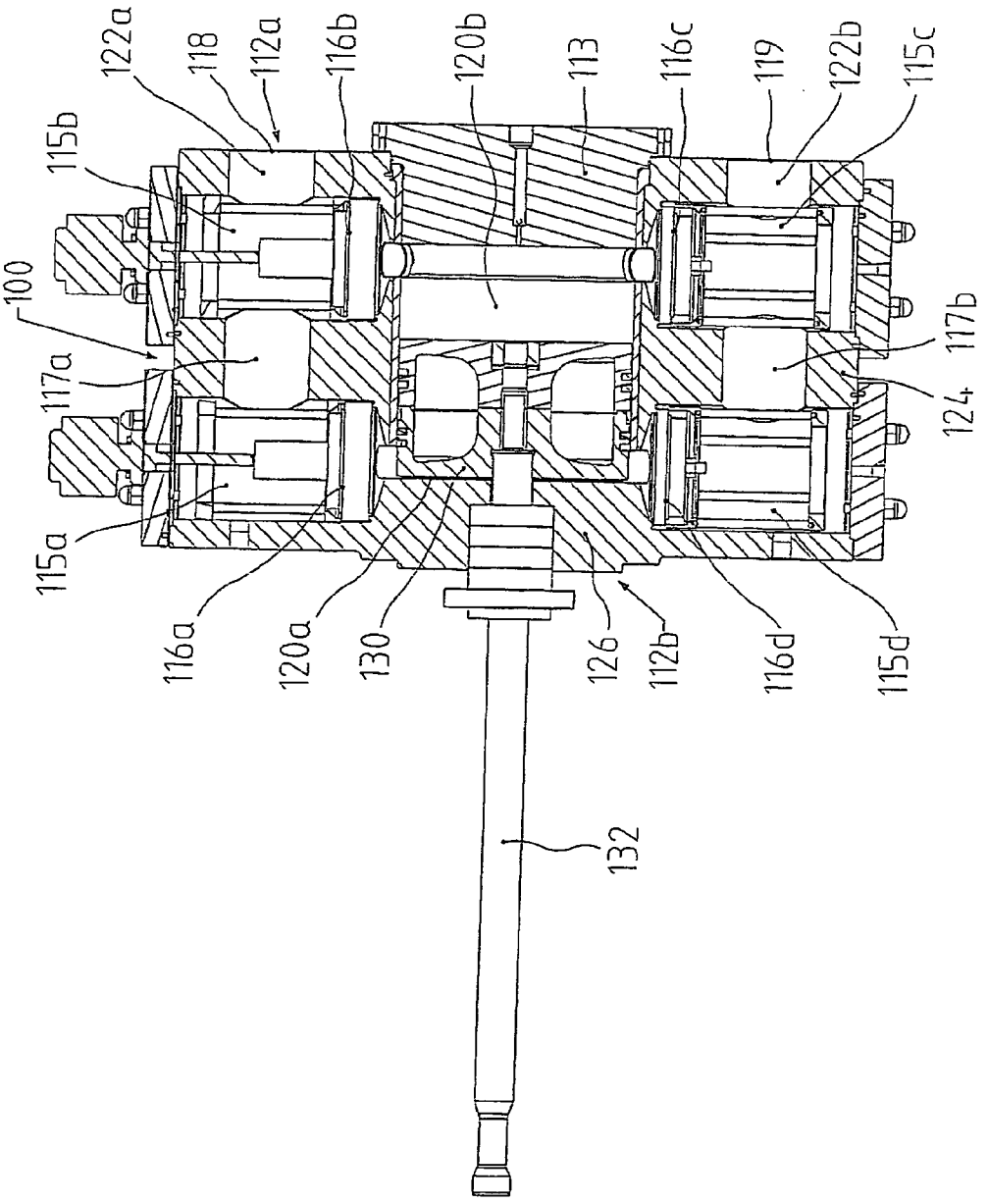
122a
118
112a
116b
120b
113
116c
119
122b
115c
115b
100
117a
117b
124
115a
116a
120a
130
126
112b
116d
115d
132

Fig.3

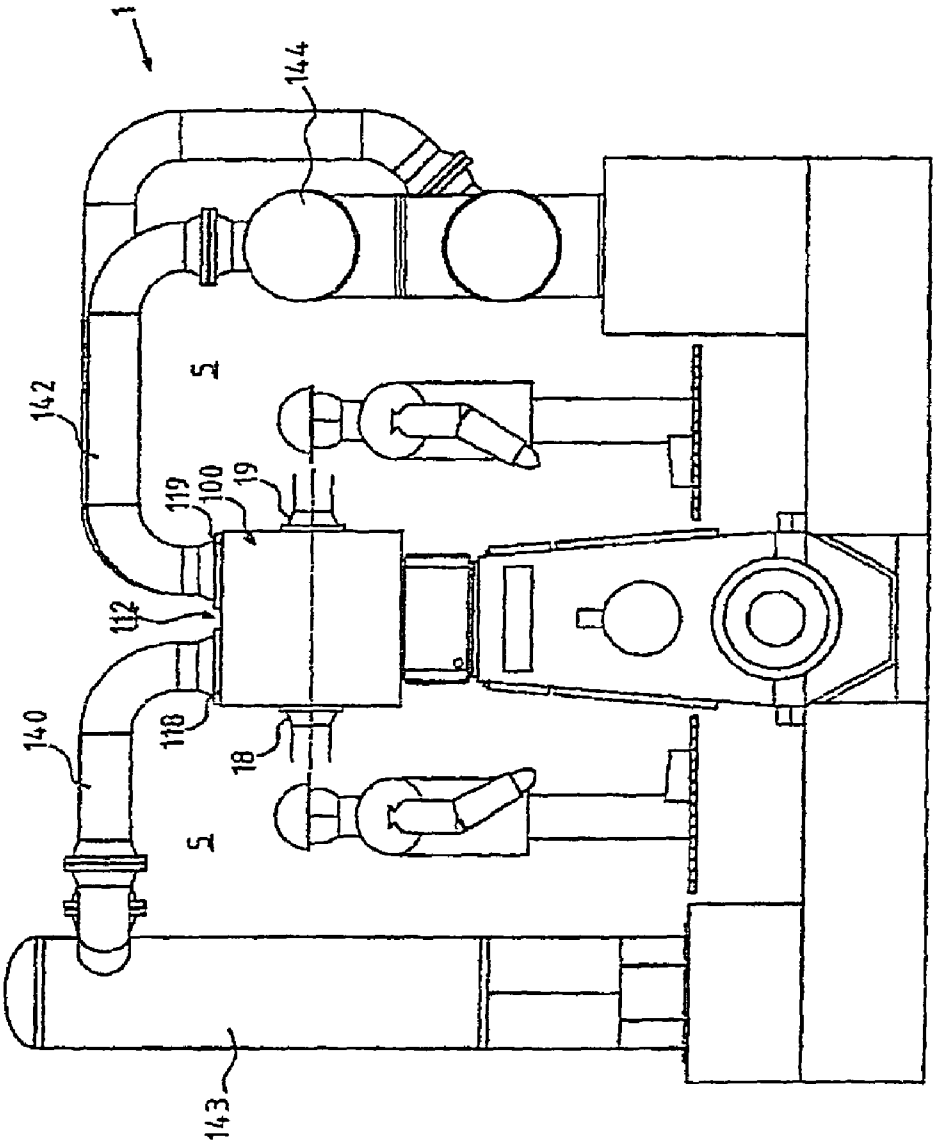

Fig. 4

PISTON COMPRESSOR

FIELD OF THE INVENTION

The invention concerns a piston compressor with at least one compression cylinder having a piston, and with one pressure port and one suction port.

BACKGROUND OF THE INVENTION

The compression cylinders of such piston compressors, which are designed for pressures of around 20 bar to 450 bar, often are no longer fabricated as sand mold castings.

Forged steel blocks or, for low pressure ranges as far as borehole diameters of around 500 mm, also cast iron blocks, chill molds, or simple model casting blocks are used as semifinished blanks.

In this kind of cylinder design, all gas spaces and channels that are formed by the inserting of sand cores during customary model casting are introduced by sometimes costly boreholes or milling work during the mechanical fabrication.

Thus, e.g., for dual-action compression cylinders, the connection of the valve chambers at the top cover and crank side has to be produced by a longitudinal borehole.

These connection boreholes have to be closed gas-tight at the end face of the compression cylinder by covers—similar to the valve covers. This gas-tight design requires a costly design solution, especially at high operating pressures.

The suction and pressure ports are arranged in the region between the particular valve chambers or directly on the respective valve chambers. Access to the space around the compression cylinder is greatly impaired by the pressure and suction pipes leading away from the suction and pressure ports.

FIG. **1** shows a dual-action compression cylinder **10** of the prior art.

The compression cylinder **10** has a cylinder chamber **25** in the middle, in which the piston **30** is arranged to move in the longitudinal direction. On either side of the piston **30** are formed two compression spaces **20***a*, **20***b*. At the end face, this cylinder chamber **25** is closed gas-tight by a cylinder cover **13**. The compression cylinder **10** has a suction port **18** in the cylinder wall **24** and opposite it a pressure port **19**, each of them emerging into a connection channel **17***a* and **17***b*, respectively. At both ends of the connection channels **17***a*, **17***b*, extending in the lengthwise direction parallel to the lengthwise axis, are arranged valve chambers **15***a* to **15***d* with valves **16***a* to **16***d*, being connected to the cylinder chamber **25** by corresponding channels. For reasons of fabrication, the connection channels **17***a* and **17***b* are open at the end face to chambers **22***a* and **22***b*, adjacent to the valve chambers **15***b*, **15***c*. Thus, they must be closed by separate covers **14***a*, **14***b* at the front end face **12***a*. At the rear end face **12***b*, the cylinder space **25** is closed off by means of a cover **26** with a gasket for the piston rod **32**. In another design, the cylinder space **25** is configured as a blind borehole. In this case, the piston rod is led through the cylinder bottom by means of a smaller borehole. Thus, the closing cover **26** is omitted.

The side ports **18** and **19** have a considerable influence on the outer dimensions of the compression cylinder **10**. Major drawbacks of this design are large size of the semifinished blanks and greatly impaired access when the compressor layout is arranged vertically. For horizontal compressors, whose compression cylinders are often braced against the foundation, the tanks lying underneath the pressure pipe often hinder this bracing.

SUMMARY OF THE INVENTION

The problem of the invention is therefore to provide a compressor that is more compact and space-saving, as well as more economical.

This problem is solved with a compressor which is characterized in that the pressure port and the suction port are arranged at one end face of the compression cylinder.

Thanks to the altered arrangement of the suction and pressure ports, both the length of the compression cylinder and the piston are considerably shortened, which correspondingly reduces the acquisition costs of the semifinished blanks. The same holds for the cylinder liner and the piston rod.

Thanks to the small mass of the cylinder and the small piston mass due to the shorter cylinder, both the static loading for the foundation and the dynamically acting mass forces of the machine are considerably reduced.

Especially in the case of vertical compressor layouts, the arrangement of suction and pressure ports according to the invention can alter the pipe laying enough to make available sufficient work space for inspection and installation jobs.

Preferably, the compression cylinder has a piston rod arranged at one end of the piston, and the pressure port and the suction port are arranged at the end face of the compression cylinder away from that of the piston rod. The ports lie in a freely accessible end face, namely, the front end face of the compression cylinder, which further simplifies the laying of pipelines.

Preferably, the compression cylinder is a dual-acting compression cylinder.

In this embodiment, the compression cylinder preferably has at suction end and pressure end two valve chambers each, spaced apart in the direction of the cylinder axis, being joined together by a connection channel closed off against the outside. By a connection channel closed off against the outside is meant a channel which is not accessible, e.g., through side boreholes or channels. Each valve chamber at the pressure end is connected via a port chamber to the pressure port and each valve chamber at the suction end via a port chamber to the suction port.

Thanks to eliminating the ports provided at the side in the cylinder wall, the connection channels, the cylinder chambers and the pistons can have much shorter configuration. Shortening of 20% to 30% is possible.

The moving of the ports to the end face can be utilized for a distinctly more compact design, especially in the case of dual-action compression cylinders.

Preferably, the compression cylinder consists of steel, especially forged steel, and the connection channel and the port chamber are formed by a single borehole. The fabrication process is considerably simplified, because the additional fabrication of separate pipeline ports in the cylinder wall is eliminated.

Compressors with such compression cylinders consisting of forged steel are used preferably in pressure ranges of 100 bar to 450 bar.

According to another embodiment, the compression cylinder consists of a cast iron block. The connection channels and the port chambers are also fabricated here by machining in accordance with the steel cylinder.

Compressors with such compression cylinders are used preferably in the range of 20 bar to 99 bar.

The cost reduction achieved by the altered arrangement of the suction and pressure ports can be further boosted in that the connection channels are merely precast by simple model casting, but no longer machined.

The cylinders of the invention can be used in horizontal, vertical, as well as V-shaped compressors.

Such compressors are used in the compression of all gases, preferably in the chemical, petrochemical and pharmaceutical industry, as well as in petroleum storage.

BRIEF DESCRIPTION OF THE DRAWINGS

Advantageous embodiments shall be explained more closely below by means of the drawings.

These show:

FIG. **1**, a compression cylinder according to the prior art

FIG. **2**, a schematic representation of a horizontal compressor in cross section,

FIG. **3**, a cross section through a compression cylinder shown in FIG. **2** with installed piston and piston rod,

FIG. **4**, a vertical compressor in side view.

DETAILED DESCRIPTION OF THE INVENTION

In FIG. **2**, a horizontal compressor **1** is shown, having in the middle a crank mechanism **2** driven by a motor and adjacent thereto at the sides two compression units, each consisting of so-called intermediate pieces **3***a*, **3***b* and a dual-acting compression cylinder **100**, having two compression spaces **120***a, b* on either side of the piston **130**.

The compression cylinders **100** each have one piston **130** in the cylinder chamber **125** that is connected to the drive mechanism **2** by a piston rod **132**.

The compression cylinder **100** is shown enlarged in FIG. **3**. As can be seen, the compression cylinder **100** is considerably shorter in configuration than is the case with the compression cylinder **100** of the prior art in FIG. **1**. The shortening here amounts to around 23%.

In the cylinder wall **124** are the valve chambers **115***a* to **115***d* with the valves **116***a* to **116***d*.

In the upper part of the diagram of FIG. **3** is the suction-side arrangement of the valve chambers **115***a*, **115***b* with the suction-side port **118**. The two valve chambers **115***a* and **115***b* are joined together by means of the connection channel **117***a*, which is closed off from the outside. In the solution of the invention, it is not necessary to provide the suction port in the region of the connection channel **117***a*. The valve chambers **115***a*, **115***b* are closed by valve covers, not shown. As a prolongation of the connection channel **117***a* is situated the port chamber **122***a*, which ends at the suction port **118**.

In the lower part of the diagram of FIG. **3** is shown the pressure-side arrangement of the valve chambers **115***c* and **115***d*. These two chambers are also joined together by a connection channel **117***b*. This channel also is closed off from the outside. Also as a prolongation is situated the port chamber **122***b* and the pressure-side port **119**.

The compression cylinder **100** shown in FIG. **3** can be made from a steel block, for example. The connection channels **117***a, b* as well as the chambers **122***a* and **122***b* are each introduced by a single borehole from the front end face **112***a*. Thus, no additional boreholes are needed for the pressure port and the suction port.

The cylinder chamber **125** is closed by the cylinder cover **113**.

The rear end face **112***b* is designed as a solid cylinder bottom **126** without cover, with a receiving borehole for the piston rod gasket, not shown here.

FIG. **4** shows a side view of a vertical compressor **1**. The compression cylinder **100** projects vertically upward and has the suction port **118** and the pressure port **119** at the front end face **112***a*. From these ports **118** and **119**, the corresponding suction and pressure pipes **140**, **142** emerge upward, so that the space **5** surrounding the compression cylinder **100** is considerably enlarged, and thus attending personnel can stand upright there to perform maintenance tasks. The suction and pressure ports **18** and **19** provided in the prior art are shown by broken lines in FIG. **4**. Furthermore, FIG. **4** shows the suction pulsation dampener **143** provided for the compressor stage and the heat exchanger **144** needed to cool down the compressed gas.

List of reference symbols

1	piston compressor
2	crank mechanism
3a, b	intermediate piece
5	surrounding space
10, 100	compression cylinder
12a, 112a	front end face
12b, 112b	rear end face
13, 113	cylinder cover
14a, b	cover
15a-d, 115a-d	valve chamber
16a-d, 116a-d	valve
17a, b, 117a, b	connection channel
18, 118	suction port
19, 119	pressure port
20a, b, 120a, b	compression space
22a, b	chamber
122a, b	port chamber
24, 124	cylinder wall
25, 125	cylinder chamber
26	cover
126	cylinder bottom
30, 130	piston
32, 132	piston rod
140	suction pipe
142	pressure pipe
143	suction pulsation dampener
144	heat exchanger

What is claimed is:

1. A piston compressor comprising: at least one compression cylinder having a piston, and with one suction port and one pressure port, wherein the suction port and the pressure port are arranged at one end face of the compression cylinder, wherein the compression cylinder is a dual-acting compression cylinder, and wherein the compression cylinder has at suction end and pressure end two valve chambers each, spaced apart in the direction of the cylinder axis, each being joined together by a connection channel closed off against the outside, and each valve chamber at the suction end is connected via a connection channel to the suction port and each valve chamber at the pressure end via a connection channel to the pressure port.

2. The piston compressor according to claim **1**, wherein the compression cylinder has a piston rod arranged at one end of the piston, and the suction port and the pressure port are arranged at the end face of the compression cylinder away from that of the piston rod.

3. The piston compressor according to claim **1**, wherein the compression cylinder consists of steel, and the connection channel and the port chamber are formed by a single borehole.

4. The piston compressor according to claim **1**, wherein the compression cylinder consists of a cast iron block and the connection channels and the port chambers are formed by a single borehole.

5. The piston compressor according to claim **2**, wherein the compression cylinder is a dual-acting compression cylinder.

6. The piston compressor according to claim **5**, wherein the compression cylinder has at suction end and pressure end two valve chambers each, spaced apart in the direction of the

cylinder axis, each being joined together by a connection channel closed off against the outside, and

each valve chamber at the suction end is connected via a connection channel to the suction port and each valve chamber at the pressure end via a connection channel to the pressure port.

7. The piston compressor according to claim **6**, wherein the compression cylinder consists of steel, and the connection channel and the port chamber are formed by a single borehole.

8. The piston compressor according to claim **2**, wherein the compression cylinder consists of a cast iron block and the connection channels and port chambers are formed by a single borehole.

9. The piston compressor according to claim **3**, wherein the steel is forged steel.

10. The piston compressor according to claim **7**, wherein the steel is forged steel.

* * * * *